UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF NEW YORK

- X

UNITED STATES OF AMERICA,

Plaintiff,

- against -

Civil Action
No. CV- 07-0835

(Seybert, J.)
(Orenstein, Ch. M. J.)

AGI-VR/WESSON COMPANY;
ALLOY CARBIDE COMPANY;
CHI MEI CORPORATION;
CLIMAX MOLYBDENUM COMPANY;
CLIMAX MOLYBDENUM MARKETING CORPORATION;
COUNTY OF NASSAU, NEW YORK;
CYPRUS AMAX MINERALS COMPANY;
GENERAL ELECTRIC COMPANY;
GTE CORPORATION;
H.C. STARCK, INC.;
KENNAMETAL INC.;
M & R INDUSTRIES, INC.;
MINMETALS INC.;
OSRAM SYLVANIA CORPORATION;
PHILIPS ELECTRONICS NORTH AMERICA CORPORATION;
SANDVIK AB;
TDY HOLDINGS, LLC; and
TDY INDUSTRIES, INC.,

Defendants.

- X

APPENDIX D PART 7 TO THE CONSENT JUDGMENT

The shift ($\Delta = DCGL_W$ - LBGR), and the estimate standard deviation in the measurements of the reference area (σ_r) and contaminant area (σ_s), available from previous survey data, are used to calculate the relative shift, Δ / σ. The relative shift used to determine the number of samples to be taken from a survey unit.

After running the statistical tests, the actual standard deviation of each survey unit will be used to recalculate the relative shift and verify that enough samples were taken for the data set. If it is determined that an insufficient number of samples were taken, additional samples will be taken from that survey unit.

The locations of the samples within each survey unit will be determined using a grid and a random number generator. Final status sampling is described in depth in Section 2.1.6.

1.6.4 Two Sample Statistical Tests

The WRS test discussed in this section will be used to compare each survey unit with an appropriately chosen, site-specific reference area. This test was chosen because contamination is present in the background at the Site. An example is also provided to better illustrate the application of these statistical concepts.

The comparison of measurements from a reference area to the survey unit is made using the WRS test (also known as Mann-Whitney test) (MARSSIM). The WRS test will be conducted for each survey unit. In addition, an elevated measurement comparison (EMC) will be performed against each measurement to ensure that is does not exceed a specified investigation level, as discussed in Section 2.3.

The WRS test is effective when residual radioactivity is uniformly present throughout a survey unit (i.e., the sample distribution is symmetrical). The test is designed to detect whether or not activity exceeds the $DCGL_W$. The advantage of a non-parametric WRS test is that it does not assume that the data are normally or log-normally distributed. This is important because it is anticipated that the data may not be symmetrical. The WRS test also allows for "less than" measurements to be present in the reference area and survey units. The on-site spectroscopy unit will be adjusted to report activities that may be less than the minimal detectable activity, MDA. The reported activities that are less than the MDA will be qualified as estimated.

The Null Hypothesis tested by the WRS test at the Site is:

Null Hypothesis (H_0): The average concentration in the survey unit exceeds the average concentration in the reference area by more than the $DCGL_W$.

Alternative Hypothesis (H_a): The average concentration in the survey unit exceeds the average concentration in the reference area by less than the $DCGL_W$.

The Null Hypothesis is assumed to be true unless the statistical test indicates that it should be rejected in favor of the alternative. Any difference between the reference area and survey unit concentration distributions is assumed to be due to a shift in the survey unit concentrations to higher values (i.e. due to the presence of residual radioactivity in addition to background that exceeds cleanup criteria). Survey units may meet the release criteria even though some measurements may be greater than some reference area measurements. Also, survey unit measurements may exceed some reference area measurements by more than the $DCGL_W$. The result of the hypothesis test determines whether or not the survey unit as a whole meets the release criterion.

Two underlying assumptions of the WRS test are:

- Samples from the reference area and survey unit are independent, identically distributed random samples; and
- Each measurement is independent of every other measurement, regardless of the set of samples from which it came.

Performing the WRS Test

The WRS test is applied as outlined in the following six steps by MARSSIM:

Step 1

Obtain the adjusted reference area measurements, Z_i, by adding the $DCGL_W$ to each reference area measurement, X_I, ($Z_i = X_i + DCGL_W$).

Step 2

The *m* adjusted reference sample measurements, Z_I, from the reference area and the *n* sample measurements, Y_I, from the survey unit are pooled and ranked in order of increasing size from 1 to N, where $N = m + n$.

Step 3

If several measurements are tied (i.e., have the same value), they are all assigned the average rank of that group of tied measurements.

Step 4

If there are *t* "less than" values, they are all given the average of the ranks from 1 to *t*. Therefore, they are all assigned the rank $t(t+1)/2t = (t+1)/2$, which is the average of the first *t* integers. If there is more than one detection limit, all observations below the largest detection limit should be treated as "less than" values

Step 5

Sum the ranks of the adjusted measurements from the reference area, W_r. Note that since the sum of the first N integers is N(N+1)/2, one can equivalently sum the ranks of the measurements from the survey unit, W_s, and compute $W_r = N(N+1)/2$ B W_s.

Step 6

Compare W_r with the critical value given in MARSSIM for the appropriate values of *n*, *m*, and σ. If W_r is greater than the tabulated value, reject the Null Hypothesis that the survey unit exceeds the release criterion. The standard deviation of the sample set is then calculated to establish the relative shift of the test. The relative shift is used to investigate whether or not the survey unit has the proper number of samples. If it is determined that an insufficient number of samples were taken, additional samples will be taken from that survey unit.

1.6.5 Elevated Measurement Comparison

An EMC will be performed on localized areas with radioactive concentrations above the $DCGL_W$. An EMC is performed by comparing an area of elevated residual radioactivity to the $DCGL_{EMC}$. The $DCGL_{EMC}$ for the Site was initially calculated using an area of area of 10 square meters (m^2). The average concentration (C_A) of the area, A with elevated residual radioactivity is calculated with the following equation:

$$C_A = (F_A)(DCGL_W)$$

This calculated value for C_A cannot be exceeded for the survey unit to meet the cleanup criteria. Using an outdoor area factor of 7.8 for Ra 226 and Ra-228 combined, in an area of 10 m^2 (MARSSIM) and a $DCGL_W$ of 5, the $DCGL_{EMC}$ would be 39 pCi/g.

If a measurement exceeding the $DCGL_W$ is confirmed, the size of the area of elevated activity, A, and the average concentration, C_A, within it will be determined by sampling the area of elevated activity. Using the area factor, F_A, for the area, A, C_A will not exceed (F_A) * ($DCGL_W$).

The required minimal detectable concentration, MDC_{scan} of the walkover survey will be calculated to ensure that elevated areas are detected at the activity determined by the area factor. Section 2.1.5.1discusses the development of the required MDC_{scan}.

If the actual MDC_{scan} is less than the required MDC_{scan}, no additional sampling points are needed for the area of elevated activity. If the actual MDC_{scan} is greater than the required MDC_{scan}, the area factor that corresponds to the actual MDC_{scan} will be calculated using the following formula:

$$F_A = \frac{ActualMDC_{scan}}{DCGL}$$

The area of the elevated activity will then be divided by the total area of the survey unit to obtain the necessary number of sample locations within the area of elevated contamination. The calculated number of samples will be mathematically rounded to the nearest whole number. The spacing of the sample locations will then be calculated in the manner described in Section 2.1.1.

A calculation will be made after the EMC has been completed to ensure that the total activity in the survey unit satisfies the release criteria established for the Site. For the calculation, the average concentration in the elevated area, C_A, and the average concentration in the entire survey unit (d) are used:

$$\frac{d}{DCGL_W} + \frac{(\text{average concentration in elevated area} - d)}{(\text{area factor for elevated area})(DCGL_W)} < 1$$

If the calculation result is greater than one, the survey unit fails to satisfy the release criteria and further excavation of the survey unit will be required.

2.0 SAMPLING LOCATIONS AND PROCEDURES

This section presents the technical approach and sampling strategy to be used during the following activities:

- Characterization Sampling and Surveys (CSS);
- Removal Action Support Surveys (RASS);
- FSS;
- Environmental Monitoring;
- Water Sampling; and
- Surface Contamination Surveys.

2.1 Characterization Sampling and Surveys

2.1.1 Site Grid System

A 10-meter grid system will be established over the areas to be excavated and will be based on existing survey control points. This grid system will be used for reference points for the Site.

2.1.2 Pre-Excavation Screening

ECC will perform pre-excavation screening surveys by making in-situ measurements with portable gamma scintillators and x-ray fluorescence (XRF) instrumentation. Contaminant readings for radionuclides and metals will be collected and reviewed to confirm the general nature, degree, and extent of previously documented contamination.

After the areas of contamination are confirmed, ECC will collect samples for characterization analyses. The characterization samples will be collected within the 10-meter grids falling above areas of confirmed contamination. The analytical data will be used to establish profiles for Li Tungsten material to demonstrate compliance with the federal and state transportation regulations and to ensure that the material conforms to the Material Acceptance Criteria (MAC) or Waste Acceptance Criteria (WAC) of selected disposal sites. The analyses also will provide quantitative values for Ra 226 and Th 232 concentrations in the excavated material and will be used to create a correlation for both the XRF instrumentation and the gamma scintillometers. Analytical results of Ra-226 will be utilized as a surrogate for Th-230, using pre-established ratios of Ra-226 to Th-230. Analytical results of Th-232 will be utilized as a surrogate for Ra-228, using pre-established ratios of Th-232 to Ra-228.

2.1.3 Correlations – XRF Instrumentation and Gamma Scintillometer

The correlations involve performing field measurements at selected soil sampling locations within the 10-meter grid nodes, collecting soil samples, and analyzing the soil samples at the on-site and/or off-site analytical laboratory. The samples will be collected

from areas of confirmed contamination and areas lying outside those areas, but within the grid system. A minimum of 5 samples will be obtained for the XRF Instrument and the Gamma Scintillometer correlations. Additional sampling analytical results may be incorporated into the correlation as the excavation proceeds.

2.1.4 Confirmation and Characterization Surveys

The purpose of the CCS is to characterize materials prior to excavation and to confirm the activity of excavated materials destined for disposal.

The CCS is performed to demonstrate compliance with the federal and state regulations governing transportation of Li Tungsten material and the MAC or WAC for the off-site disposal facility. Confirmation samples will be collected from the excavated materials. The radiological confirmatory samples will be analyzed at the onsite laboratory. Confirmatory samples collected for lead and arsenic analysis will be sent to an offsite laboratory. Quality Control of the on-site laboratory will be maintained as defined by the procedures outlined in the Contractor Quality Assurance Project Plan included in Appendix C. The radiological samples will be counted on-site using the Canberra HPGe Gamma Spectroscopy System. Soil samples contaminated with metals will be initially screened with the XRF instrument and /or sent for off-site analysis. The on-site and off-site laboratories will report concentration values for Ra-226 and Th-232 in pCi/g, and the off-site laboratory will report analytical results for arsenic and lead in milligrams per kilogram (mg/kg). The data will be used to confirm that previously calculated correlations remain accurate for both the gamma scintillation and XRF instruments. The data also will be used to confirm that the characteristics of the material conform to the disposal facility MAC or WAC as additional indicators for the RASS surveys. Analytical results of Ra-226 will be utilized as a surrogate for Th-230 as being in secular equilibrium. Analytical results of Th-232 will be utilized as a surrogate for Ra-228 as being in secular equilibrium.

The frequency of CCS will be determined by the difference between the average concentration of the residual contamination and the MAC or WAC. Fewer confirmatory samples will be collected and analyzed as the difference between the average concentration and the MAC and WAC increases.

The design of the CCS is based on the specific data quality requirements for transportation and disposal of the excavated material and the stringent demands of the RASS and FSS. The CSS provides information on variations in the contaminant distribution in an area. The contamination variation in a survey unit or grid area contributes to determining the number of data points, based on statistical tests, for the FSS.

For purposes of waste characterization and transportation, a minimum of two samples will be taken from a stockpile and analyzed by the on-site laboratory. The purpose of the samples is to verify that the upper 95% confidence limit of the average of the reported concentrations do not exceed the disposal facility WAC. The on-site laboratory using

gamma spectroscopy analyzes all samples collected during the CCS. The analysis sequence files used by the on-site laboratory assume that the radioactive decay progeny are in secular equilibrium.

Sampling Methodology

Soil samples for grid characterization will be collected from the surface to the predetermined depth using a hand auger or by excavation. The sample material will be placed into a stainless steel bowl and thoroughly mixed an appropriate volume or sample material will be placed into a plastic one liter Marinelli container. The sample container will be surveyed for radiological contamination and transferred to the on-site laboratory for analysis. QA/QC samples will be collected as described in the CQAPP (Appendix C of the Work Plan).

2.1.5 Remedial Action Support Surveys

RASS for radionuclides will be performed to collect data for dual purposes. The RASS will be performed to assist with waste segregation and to demonstrate compliance to the $DCGL_w$ for both radionuclides and metals. For the radiological RASS, HPTs performing the RASS will scan the excavation with either a shielded two-inch by two-inch sodium iodide (NaI) detector coupled to a ratemeter/scaler or an unshielded two-inch by two-inch sodium iodide (NaI) detector coupled to a ratemeter/scaler. For the metals RASS, HPTs utilizing the established grid system, will take XRF measurements at the 10-meter grid nodes within a survey unit. Survey data will provide field crews with the necessary information to segregate materials between those materials placed in Dickson Warehouse and those sent to the non-radioactive, metals contaminated soils disposal facility

Additional soil sampling during the RASS may be performed if determined necessary by survey personnel. Soil sampling may be conducted if the RASS indicates additional excavation is required, but samples in close proximity to elevated readings are below the DCGLs.

Additional remediation may be performed if an area of residual radioactive material is detected above the DCGL. The elevated area will be flagged on an excavation map if further remediation is not feasible. A comprehensive survey and appraisal of the impact of the flagged area of elevated contamination will be performed during the FSS phase.

Scanning Minimal Detectable Concentration

In order for data collected during the FSS to be valid, the MDC_{scan} must be less than the $DCGL_W$. The MDC for the instruments and technique must be calculated and identified. The default MDC_{scan} for Th-232, as listed in MARSSIM will be used for the Li Tungsten Site. The default value for a 2 in. x 2 in. NaI detector is 1.77 pCi/g.[1] The weighted

[1] Default scanning MDC is based upon a background level of 10,000 cpm for a 2 in. by 2 in. NaI detector. The observation interval was 1-sec and the level of performance was selected to yield d'of 1.38.

cpm/µR/hr is a value of 830.

If the background value of the selected instrument differs from the value of 10,000 cpm, the MDC_{scan} using the equations below as referenced in MARSSIM. An example of the calculation for MDC_{scan} is as follows:

$$MDC_{scan} = 0.99 x MDER$$

where;

$$MDER = \frac{117.1\sqrt{bcpm/60}}{cpm/\mu R/hr}$$

where;

MDER = Minimal Detectable Exposure Rate
bcpm = background cpm
cpm/µR/hr = count rate to exposure ratio for Th-232

The equation used in the example and to be applied during the RASS and the FSS incorporates a dN of 1.38 and a surveyor efficiency of 0.5.

The value of 5.06 uR/h will be used as the exposure rate for 5 pCi/g of Th-232 and its progeny. The exposure rate to soil concentration correlation was calculated using the default value as listed above. The calculation is as follows:

b_i = (10,000 cpm) x (1 sec) x (1 min/60 sec) = 166.7 counts

MDCR = (1.38) x ($\sqrt{166.7}$) x (60 sec/1min) = 1069 cpm

$MDCR_{surveyor}$ = $1069/\sqrt{0.5}$ = 1511.7

MDER = 1511.7/830 = 1.82 uR/h

MDC_{scan} = 1.8 pCi/g = $\frac{(5\,pCi/g)(1.82uR/h)}{\text{Exposure Rate per } 5\,pCi/g}$

Solving the above equation gives an exposure rate per 5 pCi/g equal to 5.06 µR/hr.

Using 5.06 uR/hr for 5 pCi/g and a cpm/uR/hr for a 2 in. x 2 in. NaI detector connected to a scaler/ratemeter, an initial action level of 4,200 cpm above background. This is the action level that will be implemented in the field during the scanning surveys. The cpm value will be verified in the field using laboratory samples as a comparison. This will provide a correlation of cpm versus the concentrations of the residual radionuclides present at Li Tungsten.

The standard MDC_{scan} value for Th-232 is less than the maximum activity concentration for Th-232 of 2.85 pCi/g. The MDC_{scan} required to detect an area of elevated activity will be calculated using the following equation from MARSSIM:

$$MDC_{scan} \text{ (required)} = (DCGLw)*(F_A)$$

The sensitive MDC_{scan} for Th-232 will be used in the field as the conservative screening method. The scanning method must be verified in the field in order to determine of the variance from background is consistently detectable. The actual MDC_{scan} will be compared to the required MDC_{scan} to assure that adequate sensitivity is met.

The *a priori* determination of the MDC_{scan} using Th-232 as the illustrative radioisotope of concern demonstrates that the scanning technique is less than maximum concentration for Th-232 of 2.8 pCi/g, therefore meeting the combined DCGL for Th-230 and Th-232.

2.1.6 Radiological Final Status Survey

The results of the FSS determine if residual radiological concentrations present in soil meet the radiological soil cleanup goals presented in Table 1-1. Analytical parameters for FSS include Ra-226 and Th-232.

2.2 Scanning Survey

A scanning survey for external gamma exposure will be performed during the FSS. The PHP will select the survey instruments and survey techniques that adequately detect residual radioactive contamination due to Th-232, Ra-226, and the respective radioactive progeny. A two - inch by two - inch NaI detector connected to a scaler/ratemeter will be used to perform the scanning survey. General area and integrated readings will be recorded for each survey unit using a global positioning system (GPS) unit. The Health Physicist Technician, HPT, will perform the survey by holding the detector close to the ground surface while slowly walking the area of the survey unit.

2.3 Elevated Measurement Comparison

The FSS addresses the concern for small areas of elevated radioactivity by using a simple comparison to the investigation level as an alternative to statistical methods. The EMC technique represents a conservative approach, because every measurement needs to be below an action level based on the surface area of residual contamination.

If the average radionuclide concentration of the area of elevated radioactivity is greater than the radionuclide-specific DCGL, then the area will be excavated and the excavated material will be stockpiled for disposal. Any area that can not be excavated will be marked on the map and incorporated into the FSS documentation and evaluation as detailed in Section 2.1.6.

2.4 Location and Frequency of Samples

Survey units will be limited to a maximum area of approximately 2,000 m^2, as evaluated for a Class 1 survey unit (MARSSIM). The Final Remedial Design Report for the Li Tungsten Site (URS Corporation, 2002) lists six survey units. The number of sampling points based on the existing data are as follows:

- Unit 1 – 14 sampling points
- Unit 2 – 8 sampling points
- Unit 3 – 6 sampling points
- Unit 4 – 12 sampling points
- Unit 5 – 5 sampling points
- Unit 6 – 16 sampling points

These sampling points are estimates as presented in the FRD. The actual numbers of sample points will be determined using in-process data according to the requirements of MARSSIM.

Final status sampling will be performed using a random-start systematic pattern. The sampling will be performed using triangular grids. The surface area for the grids eligible for final status will be estimated and the following equation will be used to determine to spacing of the systematic pattern:

$$L = \sqrt{\frac{A}{0.866n}}$$

where,

n	=	Number of samples (to be determined following the CCS);
A	=	Surface area of grids eligible for final status; and
L	=	Spacing of the systematic pattern.

A random number generator will be used to identify a coordinate location. After L is determined, a row of points will be identified parallel to the x axis, at intervals of L. A second row of points will be identified parallel to the initial row and at a perpendicular distance equal to 0.866*L from the first row. Sampling locations along the second row will be midway between the points on the first row. This process will be repeated for successive parallel rows to determine the sampling locations in each grid. If sampling locations fall outside the grid, additional sampling locations will be identified using the process described above. This process will continue until the appropriate number of sampling locations is achieved.

2.5 Sampling Methodology

Samples for the FSS will be collected using a stainless steel trowel at a depth of 15 centimeters. The sample will be placed into a stainless steel bowl and thoroughly mixed.

The homogenized soil will then be placed in a plastic one-liter Marinelli container. The sample containers will be surveyed for radiological contamination in accordance with Section 2.8 of this document and transferred to the laboratory for analysis. QA/QC samples will be collected as described in the CQAPP.

2.6 Survey Unit Release-Radiological Sampling

Areas of elevated contamination that were not excavated will be incorporated into the statistical tests that are performed during the FSS. The WRS test will be performed once the EMC criteria is achieved. After the WRS test on the survey unit is complete and the survey unit satisfies the radionuclide cleanup goals, the survey unit will be released. The WRS Test and procedure is discussed in Section 1.12.

The areas that fail to meet the limiting criteria of the EMC could not be excavated and/or fails to pass the WRS Test will require additional review. Such areas will be evaluated according to the ROD for the Site.

2.6.1 Dickson Warehouse

ECC plans to achieve the unrestricted release of the Dickson Warehouse by decontaminating the structure, as necessary, and surveying potentially contaminated surfaces according to FRD specification 02221 and accepted MARSSIM protocol. Following a structural stability survey, ECC will perform decontamination tests on select surfaces to determine the effectiveness of power-washing and vacuuming with High Efficiency Particulate Air (HEPA) filters. Assuming the decontamination tests are successful, ECC will zone the survey areas according to MARSSIM protocol and proceed with decontamination.

As required by design specification 02221-5 Section 3.4, water used for decontamination will be metered and all resulting wastewater will be collected and measured. The volume of water used during decontamination will be noted in the Daily Quality Control Report (DQCR). Other materials generated during decontamination will be collected and consolidated with similar materials.

2.6.2 Metals Sampling – Final Status

Sampling and analysis for metals will be conducted to ensure that the chemical contaminants of concern are remediated to cleanup levels and to provide screening data for compliance with the MAC or WAC of the disposal facility. Sampling and analysis for metals will be conducted in accordance with the protocols presented in SW-846. Analytical parameters for metals sampling include arsenic and lead.

2.6.3 Sampling Protocol

Samples for the FSS will be collected using a stainless steel trowel at a depth of 15 centimeters. The sample material will be placed into stainless steel bowl and thoroughly

mixed. The homogenized soil will be placed in an appropriate container. The sample containers will be surveyed for radiological contamination in accordance with Section 2.8 of this document and transferred to the laboratory for analyses. QA/QC samples will be collected as described in the CQAPP.

2.6.4 Sampling Locations

Sampling locations will be determined using a systematic random sampling method. A random number generator derives a northern and eastern starting location. A triangular grid system is then established using a spacing, L. The L value is calculated using the following equation obtained from MARSSIM:

$$L = \sqrt{\frac{A}{0.866n}}$$

where,

A = Area for metals sampling
n = Estimated number of sample locations.

Sampling locations will be established east and west of the initial random starting location. The sampling locations in the second row are midway between those of the first row. The sampling location distance is appropriate for a triangular grid system. This will be repeated for all sampling locations.

2.7 Data Evaluation

A sampling location with metal concentrations above the cleanup criteria in Table 1-1 will be excavated and stockpiled for disposal. Sample results that indicate the cleanup criteria for metals have been achieved will be evaluated to determine the confidence level of the data population.

For the set of data, S^2, the standard deviation (S), and the standard error of the mean (S_0) will be calculated. The formula for calculating S follows (SW-846):

$$S = \sqrt{S^2}$$

The formula for calculating S_0 is (SW-846):

$$S_{\bar{x}} = \frac{S}{\sqrt{n}}$$

The confidence level (CL) is then determined. The formula for calculating the CL is (SW-846):

$$CL = \bar{x} \pm t_{.20} * S_{\bar{x}}$$

The population set is considered uncontaminated if a sufficient number of samples were collected and the upper limit of the CL is less than the cleanup criteria for each metal contaminant of concern. The number of samples for each metal contaminant of concern is calculated in the sample, S^2.

2.8 Environmental Monitoring

Continuous airborne particulate samples will be collected on weekly basis and analyzed weekly on-site for gross alpha activity. The off-site laboratory will analyze 10% of the monthly composited samples. Each exposure pathway will be monitored for releases due to on-site activities. Gamma exposure will be monitored using thermoluminescent dosimetry (TLD) badges attached to the environmental monitoring stations. As a minimum, site walk-around gamma surveys will be taken weekly to provide more frequent measurements as on-site conditions change. Air samplers will be operated at the perimeter of the Site to measure airborne particulate radioactivity concentrations. Measured activities will be compared to the 10 CFR 20 airborne effluent concentration limit for Ra 226 ($9x10^{-13}$ µCi/ml-air) and Th 232 ($6x10^{-15}$ µCi/ml-air) in unrestricted areas which results in a dose to a member of the public of 50 mrem/yr. In addition to radioactive particulates, specific air monitoring will be utilized to sample any potential dispersion of metals or excessive fugitive dust, if necessary. If an airborne effluent concentration exceeds the action limit of 20 % of Table 2 of Appendix B to 10 CFR 20, an immediate evaluation of the activities that may produce elevated airborne concentrations will include the following considerations:

- Incorporate additional containment structures; and
- Increase wetting techniques and other engineering controls.

Outdoor Radon concentrations will be measured continuously using Alpha Track Etch Cups. Radon detectors will be placed in the environmental monitoring stations and will be read quarterly.

External gamma radiation dose will be measured using TLDs at each environmental monitoring station. The detectors are made of inorganic crystals, such as lithium flouride. The TLDs will be exchanged and analyzed quarterly.

2.9 Water Sampling

Sediment and erosion controls will be placed during the early phases of the remedial action. ECC will utilize the guidance of FRD specification 01560 and will include provisions for controlling surface water runoff and subsurface water. Runoff water will be diverted to prevent ponding in excavation areas. Samples of potentially contaminated

water will be collected for analyses. Analysis may include pH and radionuclide assessment. If not contaminated, the water will be filtered for particulates and reused on site for dust suppression.

2.10 Influent/Effluent Sampling

Water samples will be collected from the sampling port of the influent pipeline prior to entering the treatment process system to monitor influent contaminant concentrations. Influent water samples will be analyzed for gross alpha/beta, Ra-226/228, and pH. Data collected from these sampling events will evaluate the water, which comes into contact with the excavation and will be used to evaluate whether the water requires filtration for future use as dust suppression or discharge. Water collected from runoff, ponding areas, and decontamination operations will be used for dust suppression in clean areas of the site. ECC will use this sampling / analysis process to periodically confirm contaminated water is not being applied to clean areas of the site.

Location and Frequency of Samples

Influent water samples will be collected from a tank on a batch basis. Discrete (grab) water samples will be collected directly into sample containers.

Sampling Methodology

Samples will be placed into appropriate sample containers. All sample containers will be triple rinsed with sample water prior to collection except for pre-preserved sample containers. QC samples will be collected for according to the CQAPP.

APPENDIX C
CONTRACTOR QUALITY CONTROL PLAN
(AMENDMENT)

APPENDIX C
CONTRACTOR QUALITY ASSURANCE PROJECT PLAN AMENDMENT

Remedial Action at Parcel B and Upper Parcel C of the Li Tungsten Property of the Li Tungsten Superfund Site

Prepared at the Order of the

Environmental Protection Agency

June 2006

ECC
1746 Cole Blvd., Bldg. 21, Suite 350
Lakewood, Colorado 80401

The following Section 1.0 will replace Section 1.0 through Section 1.1 in the URS CQAPP; subsequent sections will be renumbered:

1.0 PROJECT ORGANIZATION AND PERSONNEL

The project organization is shown in Figure 1-1. Key personnel and their responsibilities for the tasks described in the Remedial Action Work Plan (RAWP) are listed below. As required by the AO, ECC will provide a New York State licensed engineer to provide oversight on all engineering matters.

1.1 Program Manager

The ECC Program Manager (PgM), Mr. Marc Mizrahi, is responsible for overall conformance of the work to Federal, State, and local regulations. PgM duties and responsibilities include the following:

- Contract execution oversight;
- Overall contract conformance to remedial design requirements and specifications, including technical, cost, and schedule;
- Overall responsibility for the success and proper execution of the Contract and all task orders;
- Tracking proposed changes to the project SOW;
- Communicating directly with performing parties regarding project execution and accountability;
- Review and timely submission of all required submittals;
- Designation of the Project Manager (PM) and Quality Control System Manager (QCSM); and
- Allocation of sufficient resources to ensure successful completion of the scope of work.

1.2 Project Manager

Mr. Phil O'Dwyer is the PM for this project. Mr. O'Dwyer reports directly to the PgM and will officially represent the Contractor in all project-related activities. The PM duties and responsibilities include the following:

- Initiation of project planning and implementation of project activities;
- Managing the project budget and schedule, with concurrence from the PgM, ensuring Contract requirements are satisfied;
- Managing all field construction activities, including the direction of project staff and subcontractors in accordance with requirements of the Contract documents;
- Tracking proposed changes to the project SOW;
- Communicating directly with the performing parties regarding project execution and accountability;

- Coordinating with the QCSM to ensure compliance with standard protocols and procedures and implementation of the RAWP;
- Ensuring Quality Control (QC) reporting and submittal requirements are completed;
- Coordinating with the Site Health and Safety Officer (HSO) to ensure implementation of the Health and Safety Contingency Plan (HSCP); and
- Procuring equipment, material, and supplies.

1.3 Construction Superintendent

Mr. Tom Gilbertson is the Construction Superintendent (CS) for this project. The CS duties and responsibilities include the following:

- Project planning;
- Maintaining the project budget and schedule up to date ensuring daily Contract administrative requirements are satisfied;
- Managing all field construction activities, including the direction of project staff and subcontractors in accordance with requirements of the Contract documents and Federal, State, and local regulations governing the project;
- Coordinating with the QCSM to ensure compliance with standard protocols and procedures and implementation of the RAWP;
- Coordinating with the HSO to ensure implementation of the HSCP;
- Maintaining the project activities logbook; and
- Procuring equipment, material, and supplies.

1.4 Quality Control System Manager

The QCSM for this project is Ms. Mirna Zahlan. Ms. Zahlan will report directly to the ECC Environmental Division Director, Mr. August Ochabauer, and has the authority to act independently in all QC matters. This person will provide part time oversight to the project and will not typically be onsite. The QCSM duties include the following:

- Supervising QC aspects of the project to ensure compliance with Contract plans and specifications as defined in the Contractor Quality Assurance Project Plan (CQAPP);
- Managing project QC;
- Approving all submittals and supervising all QC procedures;
- Maintaining communication between project management and project team members; and
- Acting as the primary spokesman on quality matters when interfacing with external organizations.

ECC's QCSM, Ms. Mirna Zahlan, will assume the responsibilities of the Construction Quality Assurance (CQA) Official, CQA Certifying Engineer, and CQA Monitors.

1.5 Certified Health Physicist

Mr. Keith Anderson is the Certified Health Physicist (CHP) for this project. His CHP responsibilities include development and implementation of all radiation safety activities. He also is responsible for the project radiation-monitoring program. In addition, the CHP will oversee all operations relating to radioactive material sampling and develop the supporting data for meeting the respective disposal facility Waste Acceptance Criteria (WAC). He also will be responsible for final status survey plans, performance of site audits, signing the HSCP, and development of data to demonstrate compliance with the remedy. He supervises the Project Health Physicist (PHP) and the HSO regarding radiation safety monitoring and reporting functions.

1.6 Site Health and Safety Officer and Project Health Physicist

Mr. Ted Johnson is the HSO and PHP. Mr. Johnson reports to the CHP and PM and will oversee the daily coordination of all radiation safety activities, including surveys, routine and special monitoring, sampling, and other health physics requirements. The HSO/PHP will operate radiation detection instruments, perform nuclear statistics collation and integration, and assist in the interpretation of analytical results. He will be responsible for maintaining proper operating conditions and calibration records for all radiation detection equipment. The PHP is responsible for supervising sampling tasks to ensure compliance with the project plans and specifications. To carry out these responsibilities, the PHP has the authority to perform the following functions:

- Implementing and enforcing the HSCP;
- Ensuring site compliance with Federal, State, and Occupational Safety and Health Administration (OSHA) safety and health regulations;
- Coordinating modifications to the HSCP with the ECC Safety and Health Manager, Corporate Certified Industrial Hygienist (CIH) and CHP;
- Maintaining the Safety and Health Logbook;
- Ensuring that the quality of data meets project QC objectives;
- Providing recommendations concerning project QC objectives;
- Ensuring consistent QC procedures are in-place during the performance of project sampling and analysis activities;
- Ensuring that QC procedures for the sampling activities are conducted in a manner consistent with EPA guidance and the CQAPP;
- Recommending corrective action procedures to maintain project QC objectives;
- Evaluating data deliverables for compliance with CQAPP requirements;
- Coordinating the implementation of laboratory and field audits with the CHP;
- Conducting field and laboratory audits to ensure that project QC requirements are implemented;
- Reviewing field and laboratory audit reports with the CHP and assist in implementing any corrective action identified by the field or laboratory audits;
- Providing technical guidance to the project management team;
- Implementing project QC requirements and coordinate field and laboratory data validation;

- Ensuring that corrective actions are implemented when out-of-control situations are identified;
- Performing announced and unannounced audits during sample collection;
- Checking chain-of-custody records for correctness and accuracy; and
- Reviewing analytical procedures and results to evaluate the analytical QC parameters of reported analytical results.

1.7 Radiochemist

The Radiochemist (RC) is responsible for the day to day operations of the on-site laboratory and will report to the PHP. The RC will calibrate and operate the gamma spectroscopy system and perform moisture testing. The RC generates on-site laboratory QC and analytical reports and is responsible for maintaining the on-site laboratory equipment.

The RC also coordinates shipment of samples for offsite alpha spectroscopy analysis and reviews data from that qualified laboratory.

1.8 Health Physics Technician

The Health Physics Technicians (HPTs) report to and interface with the HSO, CHP, and PHP for survey protocol and technical issues. The HPTs perform the radiation and metals monitoring of the materials for disposal purposes and maintain the radioactive survey records of the materials and the site. They also perform site safety monitoring activities as required to support the HSO. In addition, HPTs will collect and provide construction quality assurance data related to their duties to the PM.

1.9 Contract Laboratories

The laboratories identified in this section will be utilized for offsite analytical services as required by this CQAPP and project specifications. ECC's Project Manager will provide the facilities with the CQAPP and will ensure each maintain the required certifications. ECC will secure authorization from performing parties prior to sample shipment in the event other laboratories are considered.

SIMA Labs
Christy Music
3954 Cornell Rd.
Cincinnati, OH 45252
(513) 489-2001

Lionville Labs
Judy Stone
208 Welsch Pool Rd.
Lionville, PA 19341
(610) 280-3000

Eberline Services
Oak Ridge National Laboratory
601 Scarboro Road
Oak Ridge, TN 37830
(865) 481-0683

Paragon Analytical
Ken Campbell
225 Commerce Dr.
Ft. Collins, CO. 80524
(800) 443-1511

Figure 1-1 will replace Figure 1.1 in the URS CQAPP.

The following Section 1.3 will replace Section 1.3 in the URS CQAPP:

1.3 PROJECT DESCRIPTION

This CQAPP provides details of project management, data acquisition requirements, assessment and oversight, and data validation and usability to demonstrate that all construction activities are performed in accordance with the approved design for the RA work. The major types of activities to be conducted in this project are the following:

1. Appointment of special, qualified personnel as listed in Section 1.0 Project Management. These personnel will be responsible for assessing the QA/QC requirements and implementing those requirements, in accordance with the procedures described in this CQAPP.
2. Decontaminate and release aboveground structures in accordance with the United States Nuclear Regulatory Commission (USNRC) and USDOE release criteria. Excavate contaminated materials from within the defined soil limits as determined from previous RD fieldwork and investigations.
3. Confirm that the extent of contamination has been identified, the exposed soil surfaces contain contamination below clean-up levels established in the Record of Decision (ROD) for Arsenic, Lead, Radium-226, and Thorium-232, and that no further action is required.
4. Restore disturbed areas of the site to conditions established in the Specifications, which include obtaining the measurements necessary to approve backfill soil materials in accordance with American Society of Testing and Materials (ASTM) USDOE, and USEPA standards.
5. Certify that the excavated soil material located in the stockpile area meets Department of Transportation (DOT) and disposal facility requirements.

6. Assess the quality of laboratory and field equipment, materials, personnel and the preparation of engineering documents as discussed below in Section 3.0 of this CQAPP.
7. Produce and submit project documentation and reporting as required by the specifications and described further in Section 1.5 of this CQAPP.

Once the appropriate personnel are appointed, the Contractor will clear and grub the work area and set up to begin excavation in accordance with specifications. Included in the remedial activity is the decontamination of the Dickson Warehouse and setting up of contamination controls. The details of these activities are described in the specifications.

In order to confirm the limits of contamination and that outside these limits required no further action, sampling, sampling analysis and the interpretation of the resulting data was performed in accordance with the Multi-Agency Radiation Site Survey and Investigation Manual (MARSSIM). MARSSIM was developed and accepted jointly by the USEPA, USNRC, US Department of Defense, and USDOE to guide users through the process of identifying, characterizing, and delineating radioactive contamination and the final status survey technique (i.e., confirmation that contamination has been removed).

In order to dispose of the excavated material, characterization sampling will be performed in accordance with SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods and/or the requirements of the chosen disposal facility. To perform activities 2, 4, and 6 from above, sampling, field screening/measurements, and laboratory analysis will be conducted per this CQAPP and as discussed in the specifications.

The RA work will include the acquisition of environmental data generated from direct field measurement activities, environmental media sampling, and laboratory analyses. As performed in the supplemental investigation (SI) and discussed in the corresponding Remedial Design Work Plan (RDWP), this RA phase of work is limited to Parcel B and the upper portions of Parcel C at the site (See Drawings). Direct field measurements and sample results from laboratory analyses will be compared to the Preliminary Remedial Goals (PRO) for the contaminants of concern (See Section 2.0 of CQAPP and specifications) to establish the limits of excavation. These results plus the results from additional characterization samples taken from the stockpiled waste will be compared to appropriate waste disposal facility criteria and Department of Transportation and State regulations for waste profiling and certification during waste transportation and disposal. The other testing that will be performed during this work effort includes the evaluation of imported fill. Only the material obtained from offsite sources will be tested in accordance with ASTM, USDOE and USEPA standards.

Data acquisition techniques that will be conducted include radiological and metals soil screening, confirmatory soil sampling, building surface contamination screening, and characterization sampling of stockpiled soil. The analyses performed using these techniques include, but are not limited to, gamma screening, gamma and alpha spectroscopy, x-ray fluorescence, Toxicity Characteristic Leachate Procedure (TCLP), inorganic and organic analyses, physical parameters, etc. The collection of these data, the corresponding analyses/measurements, and specific requirements are discussed in more detail in Section 2.0 of this CQAPP and the specifications.

Products of the RA work effort will include field logs/records, measurement and analysis results, location-specific field data tables, and laboratory analytical data packages. Supporting documentation will consist of field notebooks, chain-of-custody, and sample shipping receipts. Quality assessment will be accomplished via the performance and system audits as discussed in Section 3 of this CQAPP. Data validation is addressed in Section 4 of this CQAPP, and the schedule for the implementation of the field and laboratory activities is contained in Section 10 of the Final Remedial Design Report.

The following Section 1.5.2 will replace Section 1.5.2 in the URS CQAPP:

1.5.2 Observation Logs and Testing Data

Observation logs and testing data sheets will be prepared daily by the Health Physics Technicians. In addition to the applicable items above, these logs and data sheets will include the following information:

- Descriptions and specific locations of areas being tested and/or observed and documented descriptions and locations of ongoing construction;
- Equipment and personnel in each work area, including subcontractors;
- Locations where tests and samples were taken;
- Calibrations or recalibrations of test equipment, and actions taken as a result of recalibration, when applicable;
- Quality verification documentation of offsite materials and data received; and
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality.

The Health Physics Technicians will check that no fields are left blank on the log sheets.

The following Section 1.5.3 will replace Section 1.5.3 in the URS CQAPP:

1.5.3 Construction Problem and Solution Reports

Reports describing special construction situations will be prepared by the CQA personnel discovering the problem. The reports will be cross-referenced with specific observation logs and testing data sheets and include the following information in addition to those items listed above, where applicable:

- A detailed description of the situation or deficiency;
- The location and probable cause of the situation or deficiency;
- How and when the situation or deficiency was found or located;
- Documentation of the response to the situation or deficiency;
- Results of any responses;
- Measures taken to prevent a similar situation from occurring in the future; and

- The signature of the Project Manager indicating concurrence, in addition to signatures of the CQA Official and Health Physics Technicians.

The Project Manager will be informed of any significant recurring nonconformance with the specifications or Drawings. The Project Manager will then determine the cause of the nonconformance and recommend appropriate changes in procedures or specifications. These changes will be submitted to the Program Manager for approval. When this type of evaluation is made, the results will be documented, and the Program Manager will approve any revision to procedures or specifications. A summary of supporting data sheets and a reduced-scale Site Plan showing location incident will be prepared and kept current at the site by the CQA Monitor(s).

The following Section 1.5.5 will replace Section 1.5.5 in the URS CQAPP:

1.5.5 Progress Reports

Separate from the daily reports listed above, summary progress reports will be prepared by the CQA Monitor(s) on a monthly basis, or at time intervals established at the pre-construction meeting. At a minimum, these reports will include the following information:

- A unique identifying sheet number for cross-referencing and document control;
- The date, project name, location, and other information;
- A summary of work activities during progress reporting period;
- A summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period;
- A summary of test results, failures, and any retests; and
- The signature of the CQA Official.

The following Table 3 will replace Table 3 in the URS CQAPP:

TABLE 3 SAMPLING DESIGN SPECIFICATIONS

Sampling Effort	***Methodology/Rationale***	***Matrix Location***	***Sample # and/or Frequency***	***Field Procedure #***
Excavation screening and sampling	MARSSIM	Surface and loose soil	Based on location of excavation limit – See Specifications	R100, 101, 102, 105, 106, R401, 402, 403
Building Surfaces	MARSSIM	Surface concrete	Based on grid size	100, 101, 102, 103, 104, 107, R209
Final status survey	MARSSIM	Surface soil		R100, 101, 102, 105, 106, R401, 402, 403
Stockpiled soil	SW-846	Loose soil		R402

The following section will replace in entirety the sections Excavation Support Surveys and Final Status Survey, located within Section 2.1.2 in the URS CQAPP:

Excavation Support Surveys

The objective of the excavation support survey program is to continuously refine the excavation limits, guide the excavation in depth and horizontal extent, and determine when the excavation is ready for final status survey (FSS). The excavation support survey is designed to detect the presence of contaminants of concern at or above the cleanup criteria using relatively simple equipment that give the user real-time data concerning the surficial soils. In accordance with the cleanup goals established for the site, support survey equipment will have the capability to detect the contaminants of concern at or below the remediation goals.

Pre-excavation surveys will be conducted over all estimated excavation areas, including the limits of subsequent lifts. The pre-excavation survey will establish a 10-meter grid over the estimated excavation area extending no less than 10 meters beyond the estimated limits. A scan for metals or radioactivity of each grid will be conducted prior to excavation in order to refine the estimated excavation limits. The estimated excavation limits will subsequently be adjusted as appropriate. Samples will be collected from the grid node locations. The samples will be counted using a Canberra Spectroscopy system at the onsite field laboratory and the samples for metals analysis will be analyzed onsite and then sent to the offsite laboratory. The results of these analyses and surveys will be compiled and a correlation will be established and used to convert the radionuclide units of counts per minute (cpm) to picocuries per gram (pCi/g), and to confirm the results of the x-ray fluorescence (XRF) instrumentation.

As excavation progresses, the full time survey personnel will scan the land area to be excavated and other material on a regular frequency to guide the excavation progress and direction.

Following the brief field analysis, material from approximately 10 percent of the scans will be collected and transferred to sample containers and delivered to the field laboratory where they will be counted on a Canberra Gamma Spectroscopy system or XRF, depending on the target contaminant. These results together with the field screening results, and the correlation between laboratory and field established during the pre-excavation survey will be used to reduce the field data to the units of milligrams per kilogram (mg/Kg) or pCi/g, as appropriate. The volume of samples counted by the onsite laboratory could potentially become overwhelming; therefore, the frequency of 10 percent will be used as a guideline and may be subject to change. Table 4 presents an estimate of the screening and sampling/analyses effort required to support the excavation activities as designed.

Final Status Survey

Upon completion of the excavations and prior to backfilling a FSS will be performed on areas that have been excavated or disturbed during the process of remediation. This FSS will be performed in accordance with MARSSIM. The FSS for remediated areas contaminated with radionuclides will consist of a 100% coverage scan using the appropriate scanning equipment,

and confirmatory soil sampling and analyses. The FSS for the remediated metals areas will be determined using a systematic random sampling method as described in Section 2.6.4 of the SAP. Confirmatory sample collection and analyses will be accomplished at a minimum frequency developed by SW-846. The estimated screening and sampling/analyses effort for the FSS is included in Table 4. The frequency of confirmation samples will be determined by the difference between the average concentration of the residual concentration and MAC or WAC criteria. ECC will document the frequency and difference of CQA samples collected in daily logbooks.

The following Section 2.2 will replace Section 2.2 through Section 2.2.1 in the URS CQAPP. The following sections will be renumbered:

2.2 SAMPLE HANDLING AND CUSTODY

The following protocol will be applied to all sampling during the Li Tungsten Remedial Action Work. Some variations in sample handling and custody will exist between samples collected for onsite analysis and samples collected for offsite analysis.

Custody refers to how the samples are tracked and kept in possession by authorized parties (i.e. sample collectors, laboratory sample custodians, etc.), and of how the transfer of sample possession is documented. Custodial possession is critical to show that samples have not been tampered with and remain representative of the site.

A sample is physical evidence collected from a site or facility. Sample handling and custody serves to maintain sample representativeness (i.e. the degree to which samples reflect the matrix sampled), and serves as a means of tracking samples. Every sample will be given a unique field sample designation for identification purposes. Proper sample handling and custody maintains sample representativeness by controlling and preserving samples to prevent sample degradation and to prevent cross-contamination by proper packaging. Sample handling and custody entails selection of proper sample container, sample preservation, shipping, sample custody, chain of custody, and sample packaging.

A stringent program of custody procedures will be utilized to assure that each sample is accounted for from the time of collection to completion of analysis. To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory, documentation in logbooks and a Chain-of-Custody Record will be employed.

2.2.1 Sample Identification

The method of sample identification used depends on the type of sample collected. Samples collected for specific field analyses or measurement data will be recorded directly in bound field logbooks and/or recorded directly on the Chain-of-Custody Record, with identifying information, while in the custody of the samplers.

All sample identification, chain-of-custody records, receipts for sample forms, and field records will be recorded with waterproof, non-erasable ink. If errors are made in any of these

documents, corrections will be made by crossing a single line through the error and entering the correct information. All corrections will be initialed and dated. If possible, all corrections will be made by the individual making the error. If information is entered onto sample labels, logbooks, or sample containers using stick-on labels, the labels will not be capable of being removed without leaving obvious indications of the attempt. Labels will never be placed over previously recorded information. Corrections to information recorded on stick-on labels will be made as stated above.

Sampling locations will be numbered sequentially and a sketch provided showing sample numbers and their corresponding locations. Every sample will be given a unique sample designation for identification purposes. The numbering system will be coordinated with the on-site representative to ensure that the proposed sample identifiers are discrete. The sample identification will be a series of letters and numbers consisting of three or four character strings, as follows:

PPPP-hhhh-xaaa

X PPPP is the 4 digit project code number (5601)
X "hhhh" is the unique identification assigned to each sampling location:

EA = Excavation Area
DC = Drum Contents
DS = Debris Sampled
IF = Imported Fill
PT= Post Treatment
MS = Metals contaminated soil
FT = Water samples from frac tanks
DT = Demonstration Testing
OT = Operational Testing
IW = Incineration Waste
UW = Upwind (air monitoring)
DW = Down wind (air monitoring)
SC = School Zone (air monitoring)
WZ = Work Zone (air monitoring)
SW = Source Water
FD = Final Decontamination
EW = Excavation Water
WW = Waste Water

X "x" describes the sample matrix:
1 = soil
2 = water/liquid
3 = debris
4 = air

X "aaa" represents the sample number

The sample number “5601-EA01-1001” indicates that the sample is:

X Collected for Project No. 5601;
X Collected at Excavation Area 1; and
X Is the first soil sample from Excavation Area 1.

2.2.2 Sample Preservation

Certified, commercially clean sample containers shall be used to submit samples for analysis. Sample jars or bottles will have a certificate of analysis from the manufacturer, which shows the bottles, or jars are contaminant free. Bottles or jars with preservatives added at the laboratory may lack these certificates. The laboratory will be questioned to determine that preservatives were added to certified commercially clean containers. Clean containers ensure samples are not cross-contaminated. The bottle or jar with the proper septum will be specified in the Sampling and Analysis Plan.

Sample preservation, as dictated by SW-846 method requirements, ensures samples are representative of the matrix sampled, by preventing sample degradation, volatilization, or precipitation. Samples are preserved by addition of chemical preservatives to the sample and/or by cooling the samples to 4 degrees Centigrade immediately upon sample collection. Typically, chemical preservatives are added to the sample bottle by the contract laboratory before the bottles are shipped to the site, and the bottles should indicate the added preservative. Generally, preservatives are not added to sample containers used for solid samples. The Sampling and Analysis Plan will be referenced to ensure the correct preservatives were added to the bottles by the laboratory for the types of analyses needed. Contact the laboratory for more containers if the containers are not preserved or if preservatives must be added in the field. Check the preservative levels in the bottles least once during the beginning of the project. Determine if the preservative pH is within required limits by sample preservation as specified in the Field Sampling Plan. Some sample matrices may require additional preservative. If the pH is not in the proper range, notify the contract laboratory.

2.2.3 Sample Labels

Samples collected for laboratory analyses are identified by using sample labels that are attached to each individual sample container. In some cases the sample labels may have to be included with or wrapped around the samples. The sample labels are sequentially numbered and are accountable documents after they are completed and attached to a sample or other physical evidence. The following information, at a minimum, will be included on the sample label using waterproof, non-erasable ink:

- Project number;
- Unique sample number and sample location;
- Date and time of sample collection;
- Sample description and location;
- Designation of the sample as a grab or composite;
- The signature of either the sampler(s) or the designated sampling team leader and the field sample custodian (if appropriate);

- Whether the sample is preserved or unpreserved; and
- The general types of analyses to be performed.

2.2.4 Custody Seal

After collection, separation, identification, and preservation, the sample will be maintained under chain-of-custody procedures. Possession must be traceable from the time the samples are collected until valid analytical results are obtained. The custody seal will be attached to the outside of each sample container in such a manner that it is necessary to break it in order to open the container. The date and signature(s) of the sampler(s) will be written on the custody seal, at a minimum.

2.2.5 Sample Custody

A sample is considered under custody if any one of the following conditions is met:

- It is in the actual possession of an investigator;
- It is in the view of an investigator, after being in their physical possession;
- It was in the physical possession of an investigator and then they secured it to prevent tampering; and/or
- It is placed in a designated secure area with limited or controlled access.

2.2.6 Chain-of-Custody Record

All sample shipments to on-site or off-site laboratories will be accompanied by the Chain-of-Custody (COC) record identifying its contents. The original COC record will be shipped along with the samples, while the person who initiates the record (the originator) will retain a copy. COC procedures are comprised of the following elements: 1) maintaining sample custody and 2) documentation of samples for evidence. The COC record ensures that samples are traced from the time of field collection until valid analytical results have been obtained.

When responsibility of a group of samples changes several times, each custodian is not required to retain a copy of the COC record, as long as the original COC record indicates that each person accepting the samples has subsequently relinquished custody appropriately. COC forms will be completed according to the following protocol:

- The originator will fill in all requested information from the sample labels;
- The originator will sign and date the "Relinquished by" box and keep the copy;
- The original COC record sheet will be shipped with the samples. The originator will retain a copy of the COC record. A plastic shipping envelope will be taped to the inside of the cooler top and the remaining two copies of the chain-of-custody will be inserted;
- The person receiving custody will check the sample label information against the COC record, and will also check sample condition and note anything unusual under "Remarks" on the COC form;

- The person receiving custody will sign in the adjacent "Received by" box and retain a copy of the COC record;
- The Date/Time will be the same for both signatures, since custody must be transferred between two individuals. However, when samples are shipped via common carrier (e.g., Federal Express), the date/time will not be the same for both signatures;
- When samples are shipped via common carrier, the original COC form will be shipped with the samples and the shipper (e.g., Field Sample Custodian) will keep a copy. The shipper will also keep all shipping paper, bills of lading, etc.;
- In all cases, it must be readily apparent on the COC form that the person releasing custody has relinquished it to the next custodian; and
- If samples are left unattended or a person refuses to sign, this must be documented and explained on the COC record.

2.2.7 Representative Sample Document

A representative sample document will be completed for each sample collected. The representative sample document will record the complete history of each sample, including the sample source, date collected, sample methodology, sample size and container, sample number, and the analyses required. This document will be signed by the sampler and will remain with the project records.

2.2.8 Sample Handling and Shipping

Sample material will be placed into appropriate, pre-labeled, and preserved sample bottles or jars and the sample containers will be placed on ice at 4 degrees Centigrade in an insulated cooler. The cooler will remain under observation in a shaded area. Custody over the samples will be maintained. Samples will be documented in the field logbook.

Excess soil and/or water will be removed from the sample containers before storing or shipping the samples. Appropriate PPE, as described in the Health and Safety Plan, will be worn while handling samples.

Prior to shipping the samples, COC documentation will be prepared. The COC and sample label information will be checked for agreement. The COC will accurately indicate all of the samples in the cooler. Sample containers will be wrapped in bubble wrap and placed in re-sealing storage bags prior to being placed in the cooler. The completed COC record will be inserted into a plastic bag and the plastic bag will be taped to the inside top of the cooler lid. A copy of the COC record will be retained. The method to maintaining custody for onsite and offsite samples differs slightly. The PHP and the onsite lab technician will manage onsite samples via use of logbooks and secured storage areas. These individuals will maintain control over the samples during their evaluation and any storage period. The discussion regarding packaging that follows does not apply to samples collected for onsite-only analyses.

Prior to placing sample containers in the cooler, 3 inches of packing material (waterproof Styrofoam “peanuts”) will be placed on the bottom of the cooler. Sample containers will be

placed upright inside the cooler. Ice in doubled re-sealing bags will be placed around the sample containers and on top of the sample containers. All voids will be filled with packing material. The cooler drain port will be taped shut. The cooler lid will be secured with strapping tape. Two custody seals will be placed across the cooler lid, one on the front and one on the back.

The laboratory will be notified if sample shipments will arrive on the weekend to ensure a sample custodian is present to receive the samples. The laboratory also will be notified if the number of samples per day or type of analysis is greater than that specified in the laboratory contract.

If required in the Field Sampling Plan or if sent by the laboratory, a temperature blank will be included in the sample cooler. The laboratory will measure the temperature of the temperature blank to determine the temperature of the samples upon receipt at the laboratory.

Figure 2 of the URS CQAPP will be deleted.

The following Section 2.2.10 will replace Section 2.2.3 in the URS CQAPP:

2.2.10 Sampling Files Custody Procedures

The Project Manager, or appointed field supervisor is the custodian of the sampling file and will maintain the contents of sampling files for this project, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, correspondence, laboratory logbooks, and COC forms. The sampling file will be stored in a secure, limited-access area and under custody of the CQA Official, or appointed field supervisor. Analytical laboratories will retain all original raw data information (both hard copy and electronic) in a secure, limited-access area under custody of the Laboratory CQA Official.

The following Table will replace Table 6 in Section 2.4.4 in the URS CQAPP:

Table 6
Analytical Requirements

Parameter	Method	Container	Preservative	Holding Time
Radionuclides in Soil (Ra-226, Th-232, U-238, U-234) analyzed on-site	EPA 901.1	One 1-liter Marinelli	None	Allow for Ingrowth Radon/Thoron , if required
Radionuclides in Soil (Ra-226, Th-232, U-238, U-234) analyzed off-site	Uranium- EML-02 Thorium - EML Th-01 Ra-226 - EPA 903.0/9320	One 1-liter Marinelli	None	Allow for Ingrowth Radon/Thoron, if required
Radionuclides in Water (Ra-226, Ra-228, Th-232, Total U, Gross Alpha, Gross Beta) analyzed off-site	Ra-226 - EPA 903.0/9315 Ra-228 - EPA 904.0/9320 Thorium - EML Th-01 Total U - ASTM D5174 Gross Alpha/Beta - EPA 900.0	One three-liter, high density polyethylene bottle, with a Teflon-lined lid	HNO3 to pH<2	N/A
Metals in Soil (Antimony, Arsenic, Chromium, Lead, Mercury, Molybdenum, Thallium)	Antimony - 6010B/7041 Arsenic - 6010B/7060A Chromium - 6010B/7191 Lead - 6010B/7421 Mercury - 7471A Molybdenum - 6010B/7470A Thallium – 7841	8 oz glass jars, with Teflon- lined lids	Ice to 4 degrees C	28 days - Mercury / Six months
Metals in Water (Antimony, Arsenic, Chromium, Lead, Mercury, Molybdenum, Thallium)	Antimony - 6010B Arsenic - 6010B Chromium - 6010B Lead - 6010B Mercury - 7470A Molybdenum - 6010B Thallium – 7841	One 1-liter high density polyethylene bottle, with a Teflon-lined lid	Ice to 4 degrees C; HNO3 to pH<2	28 days - Mercury / Six months
PCBs in Soil	Aroclor 1016/1242 - 882 Aroclor 1248 - 882 Aroclor 1254 - 882 Aroclor 1260 -882 Aroclor 1262 -882 Aroclor 1268 - 882	4 oz glass jars, with Teflon- lined lids	Ice to 4 degrees C	14 days

* 10% of the samples collected for chemical analysis will be sent to an off-site laboratory analysis with a CLP data reporting format.
* This table also includes analytical requirements for WAC and MAC criteria.

The following Section 3.2 will replace in entirety Section 3.2 in the URS CQAPP:

3.2 QUALITY CONTROL INSPECTIONS

The different types of QC inspection activities that will be performed under the QC plan, include:

- Field Inspections - Primarily visual examinations, but may include measurements of materials and equipment being used, techniques employed, and the final products. These inspections confirm that a specific guideline, specification, or procedure for the activity is successfully completed. They are performed either during remedial activities and/or construction, or shortly after completion of the work. Field inspections include visual verification of the presence of TLDs and alpha track etch cups at environmental monitoring stations. The results will be documented in the Daily Quality Control Report (DQCR).

- Field Tests - Tests or analyses made in connection with the site activities. They are performed primarily on samples or construction activities to determine whether the project requirements are being met. Field tests are performed upon receipt of the material to provide prompt confirmation or rejection of the material. Construction work in-progress is tested to minimize the potential of removing future construction added to defective material or work. Field tests also include radiological surveys, which establish contamination levels at specific locations of land or materials and operational checks of air sampling equipment.

- Laboratory Tests - Testing performed by on-site or off-site laboratories on samples of materials that are used to characterize the materials and confirm performance and specification compliance. These tests are performed as soon as possible after samples are obtained to provide prompt confirmation or rejection of the material or the constructed work. Laboratory tests also include on-site laboratory analyses utilizing gamma spectroscopy.

- Surveys - Surveying includes the establishment of horizontal and/or vertical grade control for construction, establishment of elevation benchmark, reference/location surveys for structures, and topography, as appropriate.

Table 7 will be deleted from the URS CQAPP. The following Section 3.4 will replace in entirety Section 3.4 in the URS CQAPP:

3.4 PREVENTATIVE MAINTENANCE

A preventive maintenance schedule will be implemented by the laboratory to minimize downtime and interruption of analytical work, and performed on a routine basis. Laboratory group leaders are required to maintain a supply of items critical to the performance of their analytical instruments. A log shall be maintained by the group leader and analyst for each major instrument, which includes information on daily response and sensitivity checks for the instrument, a record of problems, and a record of maintenance and preventive maintenance services. It is also the responsibility of the contract laboratory to have a contingency plan in place to ensure sample holding times are not jeopardized in the case of equipment/instrumentation failure.

The Contractor's or subcontractor's field equipment will be maintained under a preventive maintenance program that allows downtime to be controlled and scheduled rather than occurring unexpectedly. The appropriate field personnel, at the start of each field day, will perform evaluations and acceptance testing of environmental sampling and measurement systems and their components. The evaluations will consist of calibrating the appropriate field equipment to recognized performance standards. If the results of the daily calibration are not within the specified acceptable limits listed in the SOPs, the equipment will be deemed unacceptable and tagged out for repair. Calibration tools, gases, liquids, instruments and operating instructions will be maintained with the respective equipment in the field. Daily calibration results will be recorded on daily forms and stored in the designated file storage area at the Li Tungsten Site.

The Contractor's or subcontractor's field personnel will complete a Daily Supplies and Consumables Checklist. This checklist will insure good quality standards and adequate quantities of field supplies and consumables. Personnel who complete the inspection are required to record any deficiencies or problems.

The following Section 3.5.1 will replace in entirety Section 3.5.1 in the URS CQAPP:

3.5.1 Reference Standards

Test methods for all soil materials will be carried out in accordance with approved methods including procedures developed by ASTM. Table 5 lists those tests that may be required in the course of this project with corresponding test method references.

Section 3.5.2 will be deleted from the URS CQAPP.

The following Section 3.5.3 will replace in entirety Section 3.5.3 in the URS CQAPP:

3.5.3 Soil Amendments

Inspection of Work

The CQA Monitor(s) will perform field inspections. Inspection will consist of periodic observation of the work to verify conformance with project specifications. Inspection work will include observation of sub-grade preparation; amendment application and removal of stone over 2 inches in any dimension during topsoil placement.

The Contractor will be responsible for notifying the CQA Official at the start of each workday if anticipated activities will require observation by CQA Monitor(s). If the Contractor intends to perform multiple activities which, pursuant to this CQAPP, require observation by separate CQA Monitor(s), then the Contractor will request in writing one or more additional CQA Monitor(s) and will not commence multiple activities until the required number of CQA Monitor(s) are present.

Section 3.6.2 will be deleted from the URS CQAPP.

The following paragraph will replace the first paragraph of Section 3.6.3 in the URS CQAPP:

All survey, layout, and related work will be performed under the direction of the Project Manager, with the exception of the pre-excavation survey. The pre-excavation survey will be performed under the direction of a surveyor, registered and licensed in the State of New York throughout the life of the project.

NOTE: The selection of the contract laboratory is ongoing. Prior to final selection, ECC will confirm the candidate contract lab possesses the certifications as presented in the URS CQAPP or acceptable equivalents. ECC will seek final approval for the contract laboratory at that time.

APPENDIX D
STANDARD OPERATING PROCEDURES

SOP HS-009
MEDICAL SURVEILLANCE PROGRAM

1.0 POLICY

All ECC Environmental/Operational Division employees working in accordance with the HAZWOPER Standard (29 CFR 1910.120/1926.65) shall receive an extensive pre-employment/annual/exit medical screenings. Additional medical screening/tests may be required for specific areas of work (i.e., asbestos, radiation, lead, etc.). Personnel shall also receive periodic and follow-up examinations when appropriate. All medical monitoring information is properly documented and is maintained in each employee's personnel file.

2.0 OBJECTIVE

The objective of this Standard Operating Procedure (SOP) is to ensure that personnel are capable of performing their assigned activities and the health of employees is not compromised by potential exposure to chemical or physical agents found at work sites. This program is designed to support and monitor the effectiveness of the primary Health and Safety goal of controlling worker exposure to hazardous materials.

This procedure describes the ECC medical surveillance program requirements.

A medical surveillance program is required for employees who are or may be:

- Exposed to substances above permissible levels;
- Required to wear a respirator; and
- Exposed above permissible levels in accidents or emergency situations.

Employees who have a potential site exposure risk, work with potentially hazardous materials, are required to wear respiratory devices, or are required to be monitored under other regulations (e.g., DOT drivers) will be monitored. All employees who enter the exclusion or contamination reduction zone must participate in the medical surveillance program. Other personnel may be monitored on a case-by-case basis. All employees designated to participate in this program are required to do so as a condition of employment. Employees who do not fall within the above categories will not be included in the program.

The medical surveillance program consists of four parts: *a pre-employment medical examination, annual medical examination, project specific monitoring and/or medical examination (periodic), and exit medical examination.*

ECC's Corporate Health and Safety Manager or Project SSHO is responsible for providing the physician with the following:

- A copy of the OSHA regulation relating to hazardous waste site workers and its appendices (29 CFR 1910.120);
- Description of employee duties as they relate to exposures;
- Description of the personal protective equipment to be used;
- Information from previous examinations that may not be readily available to the physician; and
- A copy of the ECC Medical Surveillance Program.

Documentation of employee participation in the medical surveillance program and physician determination that the employees can wear PPE and respirators will be documented for OSHA record keeping purposes.

3.0 PRE-EMPLOYMENT MEDICAL EXAMINATIONS

The purpose of a pre-employment examination is three-fold. First, the examination shall identify any pre-existing illness or medical problem that may exclude a prospective applicant from employment. Secondly, the examination should determine if a candidate possesses sufficient physical capabilities to wear respiratory and personal protective equipment, work at heights, work in climatic extremes (heat and cold), and perform strenuous physical labor. Thirdly, the medical information (physical exam, spirometry, EKG, drug screening, chest x-ray (if applicable), urinalysis, audiogram) will serve as a baseline (pre-exposure) against the yearly or project specific monitoring can be compared, providing a mechanism for early detection of toxic substance exposure, and determine the employee's general fitness for potential exposure to chemicals and physical agents. ECC will fill out the Physical Examination Request Form while sending an employee for medical examination. It describes the nature of the tests to be performed. The Medical Clearance and Employee Medical Notification Form will be completed by the occupational physician and sent to ECC after the examination is completed.

During the performance of this pre-employment exam, the employee will prepare a pre-employment medical history.

In the pre-employment examination, the examining physician will determine if the prospective employee is capable of safely performing the job for that he/she is applying. At the conclusion of the pre-employment examination, the examining physician will carefully review the medical history and result of the physical examination along with laboratory reports, and then determine if the prospective employee is physically capable of safely performing the intended tasks.

4.0 ANNUAL MEDICAL EXAMINATIONS

The annual examination will include an updated medical history, including any occupational exposure from the previous year, and a detailed physical exam featuring components similar to the pre-employment examination. The physician will pay particular attention when comparing the bio-chemical parameters to help ensure that symptoms of toxic exposure that may have developed during the past year are recognized. The physician will complete and sign the medical certification/rejection section. A written report of the occupational and medical history, physical exam, and all lab work is required.

5.0 DRIVERS' MEDICAL EXAMINATION

ECC personnel do not transport hazardous materials; therefore U.S. Department of Transportation (DOT) physicals is not required. DOT physicals shall be checked for all subcontractors transporting hazardous materials for ECC. Driver physicals will consist of a short history and physical examination.

6.0 PROJECT SPECIFIC MONITORING AND/OR MEDICAL EXAMINATION

The project's treating physician will determine the contents of the project medical surveillance program. Any time an actual exposure occurs, the employee may be tested for that material and the advice of the consultant toxicologist sought. Mills-Peninsula Health Services serves as ECC's occupational medical consultant.

7.0 EXIT MEDICAL EXAMINATION

An exit medical examination is required at termination of employment or reassignment to an area where the employee would not be covered. The physician should pay particular attention to the condition of skin and document employee comments as to state of health. A written report of the occupational and medical history, physical exam, and all lab work is required.

In the event an individual leaves ECC without the required exit exam, ECC shall send a registered letter to the employee requesting a baseline physical at ECC's expense.

8.0 BOARD CERTIFIED OCCUPATIONAL MEDICAL PHYSICIAN

A Board Certified Occupational Medicine Physician shall conduct all medical surveillance examinations.

ENVIRONMENTAL CHEMICAL CORPORATION

PHYSICAL EXAM REQUISITION

Employee Name_____ Date of Exam_____

As required by 29 CFR 1910.120 (f) and 1926.65 (f), Environmental Chemical Corporation's (ECC's) Medical Surveillance Program shall be instituted by ECC for the following employees:

- All employees exposed to hazardous substances or health hazards above the PEL or published exposure levels for 30 days or more
- All employees who wear a respirator as required by 29 CFR 1910.139
- All employees who are injured/ill or develop symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation
- Members of HAZMAT Teams

The contents of ECC's medical examination shall consist of the following tests:

_____ Basic exam (medical/occupational history, blood pressure, height, weight, Vision, CBC, SMAC 23, muscle skeletal exam)

_____ Audiogram

_____ Spirometry

_____ Chest x-ray & "B" Reader (required if spirometry readings are abnormal)

_____ EKG, resting, mounted and interpreted

_____ Drug screening test (minimum 8 panel + alcohol)

_____ Additional testing requirements_____

Person Requesting Exam_____

MEDICAL SURVEILLANCE AND EMPLOYEE MEDICAL NOTIFICATION

Employee Name_____ Date_____

Type of exam: **9** Initial **9** Annual **9** Exit
Protocol: **9** Hazardous Worker **9** Administrator

Based upon my examination as per the OSHA Respirator Standard (29 CFR 1910.134), I attest that this employee (please check one):

9 Has no medical contraindication to the use of supplied air, self contained breathing apparatus and air-purifying respirators

9 Has medical restriction in the use of respiratory equipment._____
_____

As per OSHA HAZWOPER Standard (29 CFR 1910.120/1926.65), I have examined the individual above for medical conditions that would place him/her an increased risk of material impairment of health from work involving hazardous waste operations or emergency response (please check one):

9 Has no medical contraindications to full participation in hazardous waste site work; when conducted under the conditions of adequate training and a health and safety plan.

9 Has medical limitations that restrict full participation in hazardous waste site work. _____
_____

Hearing Classifications:

9 Normal
9 Hearing loss **9** Standard Threshold Shift (10 dB or more at 2000, 3000 and 4000Hz in either ear).

Employee Medical Notification:

Medical History **9** Normal **9** Abnormal_____

Physical Exam **9** Normal **9** Abnormal_____

Chest X-rays **9** Normal **9** Abnormal_____

Spirometry **9** Normal **9** Abnormal_____

EKG **9** Normal **9** Abnormal_____

Laboratory Tests **9** Normal **9** Abnormal_____

Comments _____

9 Your examination was normal
9 The abnormalities noted above have resulted in restrictions in your work duties or in your use of personal protective equipment as described in the accompanying medical evaluation form.

_____
Name of Physician / Telephone Numbers Signature of Examining Physician Date

ECC, SOP-R100
INSTRUMENT CALIBRATION AND OPERATIONAL CHECK-OUT

1.0 PURPOSE

To describe the general approach to calibration and operational check-out of survey instruments

2.0 RESPONSIBILITIES

The site health physicist is responsible for assuring that this procedure is implemented. Survey team personnel are responsible for following this procedure.

3.0 PROCEDURE

3.1 Calibration

3.1.1 Instruments to be used for quantitative measurements are source calibrated, and the initial check-out performed, prior to each specific site survey to determine necessary correction factors and to establish operating parameters and acceptable operating criteria.

Exception: The Pressurized Ionization Chamber is calibrated by the manufacturer.

3.1.2 Calibration is to be performed, when possible, with standards traceable to the National Institute of Standards and Technologies (NIST) or other industry recognized standards organizations.

3.1.3 Originals of calibration records are to be maintained at the ECC project home office; however, copies must accompany instruments to the survey location.

3.1.4 Instruments used only for qualitative scanning or screening purposes are to have an operational check-out performed prior to each specific site survey.

3.1.5 Instruments are calibrated and/or checked out as an instrument/detector combination and are to be used in that combination during survey activities.

3.1.6 Threshold values are determined based on manufacturer specifications and/or determination of specific characteristics and response. The values listed apply only to the instrument/detector

combination referenced.

3.1.7 All equipment associated with instrument and detector operations (e.g., gas tubing, flow meters, regulators, etc.) Shall be checked to assure proper working order of the complete survey system. Audio output is to be checked for consistent response with associated headphones and any necessary adapters in place.

3.2 Operational Check-Out

3.2.1 Equipment

- Detectors
- Portable ratemeter-scaler
- Cable
- Record forms
- Check sources

3.2.2 Procedure

3.2.2.1 This procedure applies to all field survey instruments.

3.2.2.2 Operational check-out is to be performed daily prior to the use of a survey instrument, and at any time the performance of the instrument is questionable.

3.2.2.3 Attach the detector to the instrument.

3.2.2.4 Turn the instrument on and check batteries, replace if necessary.

3.2.2.5 Adjust the threshold and high voltage settings to predetermined values.

3.2.2.6 Place the appropriate check source in contact with the designated location on the detector.

3.2.2.7 Determine and record the count rate on the Instrument Operational Check-Out Form.

3.2.2.8 Turn the audible output on to assure its operation.

3.2.2.9 Remove the source and determine and record the background count rate.

3.2.2.10 Compare source and background levels to previous checks.

3.2.2.11 Changes in source responses or background rate, exceeding established acceptable limits must be reconciled before the instrument can be used.

INSTRUMENT OPERATIONAL CHECK-OUT FORM

Instrument Type _____ Detector Type _____
Instrument # _____ Detector # _____
Site _____ Efficiency _____
Voltage _____ Threshold _____

Check Out Date	Background (c/__m)	*Source Type: ID#: c/__m	**Source Type: ID#: c/__m	Checked Out By	Comments (see reverse)

Background Response limits _____to _____ c/m
*Source Response limits _____to _____ c/m
**Source Response limits _____to _____ c/m

“

Date Reviewed

ECC, SOP-R101
ELECTRONIC CALIBRATION OF RATEMETERS

1.0 PURPOSE

To describe the procedure for calibration of ratemeters.

2.0 RESPONSIBILITIES

The site health physicist is responsible for assuring that this procedure is implemented. Survey team personnel are responsible for following this procedure.

3.0 PROCEDURE

3.1 Equipment

3.1.1 Portable ratemeter: Model PRM-6, Eberline Instrument Corporation; or equivalent.

3.1.2 Pulse generator: Model 500, Ludlum Instrument Co.; or equivalent

3.1.3 Cable: MHV-C; or other connectors, as applicable.

3.1.4 Record forms.

3.2 Procedure

3.2.1 Turn ratemeter on and check batteries; replace if necessary.

3.2.2 Turn the ratemeter off and connect to the pulse generator.

3.2.3 Turn the pulse generator on.

3.2.4 Set the pulse amplitude to 50 mV and the amplitude adjustment knob to 5 on the analog scale.

3.2.5 Turn the ratemeter onto HV setting. Check instrument voltage reading and pulser voltage reading. (If a difference of 50 V or greater is noted, remove the instrument from service) Record both readings on the Electronic Calibration Record Form.

3.2.6 Set the multiplier knob to the 1K scale.

3.2.7 Set pulse rate to 400,000 pulses/min. Using the multiplier adjustment knobs.

3.2.8 Set ratemeter to a x 1,000 (1K) scale. Record reading.

3.2.9 If necessary, adjust the 1K potentiometer (pot) inside the ratemeter to bring reading to 400,000 cpm. Record adjusted response.

3.2.10 Decrease the pulse rate to 40,000 pulses/min. by setting the multiplier knob to the 100 scale.

3.2.11 Set ratemeter to the x 100 scale. Record reading.

3.2.12 If necessary, adjust the x 100 pot inside the ratemeter to bring reading to 40,000 cpm. Record adjusted response.

3.2.13 Decrease the pulse rate to 4,000 pulses/min. by setting the multiplier knob to the 10 scale.

3.2.14 Decrease the pulse rate to 4,000 pulses/min. by setting the multiplier knob to the 10 scale.

3.2.15 Set the ratemeter to the x 10 scale.

3.2.16 If necessary, adjust the x 10 pot inside the ratemeter to bring reading to 4,000 cpm. Record adjusted response.

3.2.17 Decrease the pulse rate to 400 pulses/min. By setting the multiplier knob to the 1 scale.

3.2.18 Set the ratemeter to the x 1 scale. Record reading.

3.2.19 If necessary, adjust the x 1 pot inside the ratemeter, to bring reading to 400 cpm. Record adjusted response.

3.2.20 Set ratemeter to x 1,000 (1K) scale.

3.2.21 Set the multiplier knob to the 1K scale.

3.2.22 Set pulse rate to 200,000 pulses/min. using the multiplier knobs. Record reading.

3.2.23 If necessary, adjust the x 1,000 (1K) pot, inside the ratemeter, to bring readings to 200,000 cpm. Record adjusted response.

3.2.24 Repeat steps 3.2.10 thru 3.2.19 for 20,000 pulses/min. Thru 400 pulses/min. To insure calibration stability. If stability is not achieved, remove the instrument from service.

3.3.26 Turn off ratemeter and pulse generator and disconnect the cables.

ELECTRONIC CALIBRATION RECORD

Instrument Type_____

Instrument Number_____

Pulsar Type/Number_____

Pulser Voltage	Instrucment Voltage

Instrument Scale	Pulser Scale (pulses/min)	Initial Instrument Reading (c/m)	Adjusted Instrument Response (c/m)

Remarks _____

_____

_____

_____

Calibrated By_____ Date _____

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RFP/004/1200/REV0

ECC, SOP-R102
GAMMA SCINTILLATION DETECTOR CHECK-OUT AND CROSS CALIBRATION

1.0 PURPOSE

To describe the procedures for cross calibration and operational check-out of gamma scintillation detectors

2.0 RESPONSIBILITIES

The site health physicist is responsible for assuring that this procedure is implemented. Survey team personnel are responsible for following this procedure.

3.0 PROCEDURE

3.1 Equipment

3.1.1 Ratemeter: Model PRM-6, Eberline Instrument Corporation; or equivalent.

3.1.2 Sodium iodide detector: Model 489-55, Victoreen Instrument Co.; Model SPA-3 or Model PG-2, Eberline Instrument Corporation; or equivalent.

3.1.13 Pressurized Ionization Chamber (PIC), Model RSS-111 or Model RSS-1011, Reuter Stokes Co.

3.1.4 Cable: MHV-MHV; or other connectors, as applicable.

3.1.5 Record forms.

3.1.6 Calibration source.

3.1.7 Check source.

3.2 Procedure

3.2.1 Turn ratemeter on, check batteries, and replace if necessary.

3.2.2 Adjust he high voltage to approximately 900 V.

3.2.3 Turn ratemeter off. Attach scintillation detector and turn ratemeter back on.

3.2.4 Determine the background count average with the ratemeter set to slow response. Record the average count rate on the first data line of Instrument Operational Check-Out Form.

3.2.5 Determine the acceptable background response limits by setting the ratemeter to fast response. Record the actual lowest and highest values observed.

NOTE: If the site background is not consistent with the predetermined background response range, a new range shall be established and noted on the form.

3.2.6 Choose a check source with a gamma energy distribution representative of the radioactive material of concern at the survey site.

3.2.7 Determine the check source count rate by placing a gamma check source (e.g., Co-60, Cs-137) on the front of the detector. Record the count rate on the first data line of the record form. Also, determine and record the " 10% variation of the check source count rate as the source response limits.

NOTE: The form and check source are to accompany the instrument to the field survey site.

3.2.8 Perform cross-calibration.

3.2.8.1 Assemble PIC, turn on, check batteries, and allow to stabilize approximately 5 minutes.

3.2.8.2 Place the PIC at a location of measurable activity. If no such areas are present perform the calibration at 6 to 10 locations on the site. Adjust the tripod to position the center of the PIC chamber at 1 meter above the surface.

3.2.8.3 Determine the exposure rate (see SOP-R206). Record on Cross Calibration Form.

3.2.8.4 Remove the PIC and measure the scintillation detector count rate at 1 meter above the surface. Record this value on the Cross Calibration Form.

3.2.8.5 Repeat steps 3.2.6.2 to 3.2.6.4 for locations of different radiation intensities. If possible, obtain calibration points throughout the entire range of radiation levels noted on the site. In this case, a minimum of 5 different measurements in each of the ranges - <20FR/h is recommended.

3.2.8.6 Prepare a calibration curve of detector count rate versus exposure rate. There is a

computer program which will generate a table of these values.

NOTE: Calibration curves determined using cable lengths of 3 meters or less are not necessarily applicable to instrument/detector combinations using cables greater than 3 meters long.

3.2.9 Consistent Instrument Display

For sites where several instrument/detector units will be used in the same area, units may adjusted to display similar responses.

3.2.9.1 Obtain a gamma radiation source with an activity great enough to be distinguished at a distance of 1 meter.

3.2.9.2 Place each of the detectors at a prescribed distance from the source and check readings. The distance should be a minimum of 3 feet, chosen to give a detector/instrument response >10,000 cpm.

3.2.9.3 If all units do not respond within 10% of each other, adjust the high voltages to obtain the same meter response. The voltage should be between 750 and 950 volts; if outside this range, do not attempt to use detector for this purpose.

3.2.9.4 Record operational voltage on the Instrument Operational Check-Out Form. If the voltage has been set to a value other than 900V, indicate in the Comments section that the Operating Voltage was adjusted to allow for consistent response between instruments at this site.

SITE BACKGROUND DETERMINATION

Location _____

AVE _____

3¤_____

Range _____ to _____

MDA _____dpm/100cm^2

Performed By: _____

Date: _____

Location _____

AVE _____

3¤_____

Range _____ to _____

MDA _____dpm/100cm^2

Performed By: _____

Date: _____

Comments:

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RFP/005/1200/REV0

INSTRUMENT OPERATIONAL CHECK-OUT FORM

Instrument Type _____ Detector Type _____
Instrument # _____ Detector # _____
Site _____ Efficiency _____
Voltage _____ Threshold _____

Check Out Date	Background (c/__m)	*Source Type: ID#: c/__m	**Source Type: ID#: c/__m	Checked Out By	Comments (see reverse)

Background Response limits _____to _____ c/m
*Source Response limits _____to _____ c/m
**Source Response limits _____to _____ c/m

“

Date Reviewed

CROSS CALIBRATION FORM

Site _____ PIC Number _____ Surveyors _____

Calibration Point											
Date											
PIC Readings *F*r/hr											
Observed Readings in K Counts/Minute											
Meter / Detector No. No.											
/											
/											
/											
/											
/											
/											
Mean: Meter											

Remarks:

_____

RFP/006/1200/REV0

ECC, SOP-R103
OPERATION OF LUDLUM MODEL 2929 W/43-10-1 ALPHA/BETA DETECTOR

1.0 PURPOSE

To describe the procedure for performing the daily performance check and operation of the Ludlum Model 2929 W/43-10-1 Alpha/Beta Detector. The instrument will be used to analyze routine smears, air particulate samples, and other samples that are to be analyzed as determined by the Project Health Physics (PHP).

2.0 DEFINITIONS

Accuracy –The degree of agreement of the observed value with the conventionally true value of the quantity being measured.

Adjust – To alter the response by means of variable built-in control such as a potentiometer.

Calibrate –To adjust or determine or both: (1) the response or reading of and instrument relative to a series of conventionally true values; or (2) the strength of a radiation source relative to a standard of conventionally true value.

Check – The use of a source to determine if the detector and all electronic components of the system are operating correctly.

Check Source – A radioactive source, not necessarily calibrated, used to confirm an acceptable level of instrument response to radiation exposure.

Detector – Any device for converting radiation flux to a signal suitable for observation and measurement.

Primary (or national) Standard – An instrument, source, or other system or device maintained by the National Institute of Standards and Technology (NIST).

Secondary Standard – An instrument, source, or other system or device that has been compared directly with a national standard. Generally reserved for use as a laboratory standard.

Test – A procedure whereby the instrument, component, or circuit is evaluated against certain criteria for satisfactory operation.

Traceability – The ability to show, through documentation, that a particular instrument or radiation source has either been calibrated using the national standard or has been calibrated using the national standard or has been calibrated using a transfer standard in a

Created by .chain or echelon of calibrations, ultimately leading to comparison with the national standard.

3.0 RESPONSIBILITY

Project Health Physics - Responsible for assuring that the procedure is implemented and development and maintenance of the procedure.

Health Physics Technician - Responsible for following the procedure.

Certified Health Physicist - Approve all revisions to the procedure.

4.0 INSTRUMENT CONTROLS AND SPECIFICATIONS

- LCD Display – The LCD displays are high resolution 6 segment displays. One for Alpha and one for Beta.
- High Voltage Meter – Linear meter ranging for 0-2.5 Kilovolts.
- High Voltage Potentiometer – The High Voltage potentiometer is a ten turn venier switch used to set the high voltage. It is equipped with a locking device to prevent accidental adjustment.
- Timer Switch – the timer switch is an adjustable thubwheel switch able to adjust timing sequencies from 00-99.
- Time Multiplier Switch – the time multiplier switch is a four-position switch used to multiply the time sequence set by thumb switch. The four positions are 0.1min, 1.0 min., 10min.and Ext. The Ext position is used as continuos time or when the 2929 is being controlled by and external system.
- Volume Switches – The unit is equipped with two volume control switches one for Alpha and one for Beta.
- Count button – the count button allows for the start of counting when pressed.
- Count Light – the count light is lit whenever the unit is the counting mode.
- Hold Button – the hold button allows for the termination of a count, which is in progress.
- Power Switch – this switch is used to turn the instrument on/off.
- AC Power Light – this switch illuminates whenever the power switch is turned on and the instrument is connected to AC power.
- Coaxial Connector – The instrument utilizes a coaxial connector (usually C series) to connect to a 43-1-10-1 detector.
- Sample Holder – Anodized aluminum tray with 1” diameter sampler ring to allow for 1” or 2” diameter samples.

5.0 ENVIRONMENTAL FACTORS

The temperature range and humidity are recommendations by the manufacture. Questions concerning the following recommendations should be directed to the PHP. The PHP is responsible for ensuring that these conditions are met and any deviation must be approved by the CHP.

- Temperature Range - Ludlum recommendations for temperature range of the Model 2929 are –4 degrees F (-20 degrees C) to 122 degrees F (50 degrees C).
- Humidity – When exposed to a relative humidity level of 95% (non-condensing) for eight hours, and upon return to 40% for 4 hours at ± C (Oak Ridge National Laboratory Instrument Evaluation Summary Ludlum Model 2929 Dual Scaler)

6.0 EQUIPMENT AND MATERIALS

The following is a list of equipment and materials needed to operate the Ludlum Model 2929. The PHP may authorize equipment substitution with the concurrence of the CHP.

- Ludlum Model 2929 w/43-10-1
- Alpha source, Th^{230} dpm value of 2,000 (or similar)
- Beta source, Tc^{99} dpm value of 14,000 (or similar)
- Forms (Instrument Daily Check Log (IDCL) and Fixed and Removable Activity Survey Form (FRASF)).
- Electrical extension cord (as appropriate).
- Portable gas generator (as appropriate).
- 47mm glass fiber filters.
- Planchetts.
- Rubber gloves
- Cleaning equipment
- Tweezers.
- Calculator.

7.0 INSTRUMENT INSTALATION

7.1 Match the calibrated Ludlum 2929 with the appropriate Ludlum43-10-1 detector prior to use.

7.2 Provide electrical or battery power to the instrument.

7.3 Turn on the power switch and verify that the high voltage and the venier settings is correct. The high voltage and venier setting are listed in the calibration sheets. Contact the PHP if the settings are incorrect prior to proceeding.

8.0 DAILY PERFORMANCE CHECK

The following instructions must be completed prior to the use of the instrument. Changes or substitutions must be approved by the PHP.

8.1 Clean the sample holder prior to starting the daily performance check.

8.2 Turn on the power switch and verify that the high voltage reading and the venier settings are correct.

8.3 Document the following on the IDCL form: (1) instrument serial number, (2) detector serial number, (3) instrument calibration due date, (4) alpha source ID number, (5) alpha source isotope, (6) alpha source dpm value, (7) beta source ID number, (8) beta source isotope, (9) beta source dpm value.

8.4 Wearing rubber gloves and using tweezers place an unused 47mm filter on a clean planchet. Open the sample holder place the planchet into the counting chamber. Close and lock the sample holder. Perform a 20 minute background count. Adjust the timer switch to 20 and the time multiplier switch to 1.0 minute to set the count time.

8.5 Record the total background counts for alpha and beta in the Background Total Counts column of the IDCL form.

8.5.1 Calculate the background count rate in counts per minute (cpm) using the following formula:

$$cpm_B = \frac{C_B}{t_B}$$

where:

cpm_B	=	background countrate (cpm);
C_B	=	number of counts recorded for counting period; and
t_B	=	time of counting period (minutes).

8.5.2 Report the results to the PHP if the background count rate exceeds $\pm$ 3-sigma average recorded count rate.

8.6 Place the appropriate alpha source (as indicated on the IDCL form) on a clean planchet, ensuring that the writing on the source is face down. Open the sample holder and place the source and planchet in the counting chamber. Close the sample holder and lock in place. Adjust the timer switch to 1 and the time multiplier switch to 1.0 to set the count time. Record the count on the IDCL form in the source check column.

8.7 Remove and replace the alpha source with the appropriate beta source. Perform the count the same as in step 8.6.

8.7.1 Calculate the total efficiency using the following formula:

$$E_t = \frac{\frac{C_{source}}{t_{source}}}{dpm_{source}}$$

where:

E_t	=	total efficiency;
C_{source}	=	number of counts recorded for counting period;
t_{source}	=	time of counting period (minutes); and
dpm_{source}	=	number of disintegrations emitted by the source.

8.7.2 If the efficiency is greater or less than $\pm$ sigma, notify the PHP and remove the instrument form service.

8.8 The minimum detectable activity (MDA) is calculated as:

$$MDA = \frac{3 + 4.65\sqrt{B}}{E_t}$$

where:

MDA	=	Minimum detectable activity (dpm);
B	=	Background count rate (cpm); and
E_t	=	Total efficiency (counts per disintegration).

8.9 The HPT will initial the IDCL form.

9.0 ROUTINE SAMPLE COUNTING

The following instructions are for counting and analyzing of routine smears.

9.1 Document the following on the FRASF form: (1) Instrument Model, (2) Instrument Serial Number, (3) The efficiency for alpha and beta/gamma, (4) background for alpha and beta/gamma, (5) The MDA for alpha and beta/gamma.

9.2 Wearing rubber gloves and using tweezers place the smear on a clean planchet. Open the sample holder, place the planchet and filter in the counting chamber. Close and lock the sample holder. For routine smears count for 1 minute. Adjust

the timer switch to 1 and the time multiplier switch to 1.0 minute to set the count time.

9.3 Record the counts on the fixed and removable activity survey form.

9.4 Calculate the dpm using the following formula (NUREG-1575):

$$dpm_S = \frac{\frac{C_{S+B}}{t_{S+B}} - \frac{C_B}{t_B}}{E_t}$$

where;

dpm_S	=	sample activity
C_{S+B}	=	counts for sample plus background for counting period;
t_{S+B}	=	time period for sample count (min);
C_B	=	counts for background for counting period;
T_B	=	time period for background count (min);
E_t	=	total efficiency (counts per disintegration).

Record the dpm in the appropriate column on the fixed and removable activity survey form.

10.0 EMERGENCY CONDITIONS

The following procedures are to be followed in the event of weather conditions that cause a power outage or other situations that may cause the interruption of electrical power

10.1 After the power has been restored follow steps in section 8 of this procedure.

ECC, SOP-R104
GM DETECTOR CALIBRATION AND CHECK-OUT

1.0 PURPOSE

To describe the procedures for calibration and operational check-out of GM detectors.

2.0 RESPONSIBILITIES

The site health physicist is responsible for assuring that this procedure is implemented. Survey team personnel are responsible for following this procedure.

3.0 PROCEDURE

3.1 Equipment

3.1.1 Portable ratemeter-scaler: Model PRS-1 (Rascal), Eberline Instrument Corporation; Model 2200 or 2221 Ludlum Instrument Corporation; or equivalent.

3.1.2 GM detector: Model HP-260 (GM APancake@), or equivalent.

NOTE: The HP-260 detector face may be covered with a thin layer of tracing paper to provide a total thickness of 7 mg/cm^2 which will increase the degree of protection of the detector face from accidental puncture and contamination and shield out alpha particle contributions. If a shield is to be used, all calibration and operational check-out procedures should be performed with the shield in place.

3.1.3 Cable: CP1-BNC; C-BNC; or other connectors, as applicable.

3.1.4 Record forms.

3.1.5 Calibration sources.

3.1.6 Check source.

3.2 Procedure

3.2.1 Attach the GM detector to a portable ratemeter-scaler.

3.2.2 Turn instrument to HV. Note condition of battery as indicated by digital display. Press the

ALIGHT@ switch. If the ABATT OK: legend does not remain displayed, battery power is marginal and batteries should be replaced.

3.2.3 Set the threshold display accordingly for the following combinations.

PRS-1/HP260	5.0	(50mv)
Ludlum 2220/HP260	500	(50mv)
Ludlum 2221/HP260	500	(50mv)

3.2.4 Adjust the high voltage to 900 volts.

3.2.5 Determine the detector background for 1 minute. Repeat 10 times. Calculate the average value, the 3 sigma deviation and the allowable range. Record the information on the Calibration Form.

3.2.6 Select a beta calibration source which will provide approximately 10,000 cpm.

3.2.7 Place the detector on the source and accumulate counts for 1 minute. Record the source identification number and the source count.

3.2.8 Subtract the background count rate from the calibration source counts.

3.2.9 Calculate the detector efficiency and round the result to two significant figures. Record the operating efficiency. (The counting efficiency typically ranges from 22-27%).

3.2.10 Calculate the minimum detectable activity (MDA) using the following formula:

$$MDA(dpm/100cm^2) = \frac{2.71 + (4.64\sqrt{B}}{T \times E \times \text{other modifying factors}}$$

B = background (total counts)
T = count time (min) to be ysed for field measurements
E = operating efficiency $\frac{\text{counts}}{\text{Disintegration}}$
G = $\frac{\text{geometry detector area } cm^2}{100}$

This formula calculates the activity level in dpm/100 cm^2 which can be detected with 95% confidence of having neither a false positive nor a false negative result.

Compare this value to the site guidelines to determine adequate sensitivity of the instrumentation. An MDA that is less than 50% of the applicable criteria is desirable.

3.2.11 Position a beta-gamma check source (e.g., Co-60, Sr-90) on the detector. Accumulate the count for one minute. Record the count rate and time. Remove the detector from the source. Reposition the detector and source and repeat the count. Repeat 10 times. Calculate average value and the 3 sigma deviation. The 3 sigma value should be # 20% of the mean. If it is not, the detector must be removed from service until repairs can be made. Record all information.

NOTE: This same check source is to accompany the calibrated instrument to the field survey site.

3.2.12 Prepare a daily Instrument Operational Check-Out Form. Enter the average check source count rate, the average background count rate and count times on the first data line. Enter acceptable range limits for check source and background response.

NOTE: This form accompanies the instrument to the survey site.

3.2.13 Daily instrument operational check-out is performed according to SOP-R100.

CALIBRATION DATA --ALPHA/BETA

Site _____

Instrument Type _____ Instrument Number _____

Detector Type _____ Detector Number _____

Calibration Source: Radionuclide _____
ID Numbers _____ _____
_____ _____

Purge Check: 1st _____ Time _____
2nd _____ Time _____

Source Disintegration Rate (dpm)	Gross Instrument Count Rate (cpm)	Net Instrument Count Rate (cpm)	Efficiency (cpm/dpm)		Check Source Reproducibility Test (c/__m)

Operating Efficiency _____ Ave = _____
(highest activity source) 30 = _____

High Voltage _____ Thershold _____ Window _____

Check Source Radionuclide _____ Check Source I.D. # _____

Position of Check Source Relative to Detector _____
Average
Background c/__m _____ Check Source Range _____ To _____ c/__m
(Ave +-30)
IMPORTANT: ALL OF THE ABOVE INFORMATION MUST BE PROVIDED
Date _____ Calibrated by _____

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BACKGROUND DETERMINATION

Location _____

_____

AVE _____

3σ_____

Range _____ to _____

MDA _____dpm/100cm^2

Performed By: _____

Date: _____

Comments:

INSTRUMENT OPERATIONAL CHECK-OUT FORM

Instrument Type _____ Detector Type _____
Instrument # _____ Detector # _____
Site _____ Efficiency _____
Voltage _____ Threshold _____

Check Out Date	Background (c/__m)	*Source Type: ID#: c/__m	**Source Type: ID#: c/__m	Checked Out By	Comments (see reverse)

Background Response limits _____to _____ c/m
*Source Response limits _____to _____ c/m
**Source Response limits _____to _____ c/m